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ABSTRACT

The purpose of this paper is to summarize an issue instruction environmental education program developed by Harold Hungerford and his associates over the past three decades. The primary focus of the issue instruction program is on the development and application of investigation and evaluation skills to environmental problems and issues. Program materials take a structured approach to the development of these skills and encourage the teacher to become a guide and facilitator during the skill application. The paper documents the development of various program elements and summarizes related research used to further refine and extend the program. (Contains 120 references and 5 tables.) (Author/YDS)

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AN OVERVIEW OF AN ISSUE AND ACTION INSTRUCTION PROGRAM FOR STEWARDSHIP EDUCATION

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Abstract – The purpose of this paper is to summarize an issue instruction environmental education program developed by Harold Hungerford and his associates over the past three decades. The primary focus of the issue instruction program is on the development and application of investigation and evaluation skills to environmental problems and issues. Program materials take a structured approach to the development of these skills and encourage the teacher to become a guide and facilitator during the skill application. The paper documents the development of various program elements and summarizes related research used to further refine and extend the program.

Preface

Early in the development of this paper and document, I expressed some reservations about the term and concept "best practices." I would like to briefly summarize my concerns here as a short preface to this paper.

To begin, it should be acknowledged that "best practice" is one of several terms that now appear in the literature and in informal use. Several other terms in use include "standard practice," "sound practice," and "common practice." Holsman (2001) refers to common practices as those that are commonly used in a given field. Common practices are usually practical (i.e., they have worked in practice over time), and have some traditions associated with their use. Further, it is often assumed there is some type of research base to them, whether or not that is true. Professionals (or fields) can get into trouble with common practices when tradition overrides the absence of research, or worse, when research runs contrary to assumptions related to those practices. For example, in EE, many have assumed that the Raths-Harmon-Simon approach to values clarification is supported by research, despite a careful review of this body of the research that clearly indicates otherwise (Lemming, 1985).

Next, I'd suggest that the term "best practices" cannot be easily applied to aquatic resource education (ARE) or environmental education (EE). First, from a research and evaluation perspective, the evidence base in the fields of ARE and EE is limited in its ability to support strong claims about the value of many of our practices (and programs). In some cases this research has not been done and, in cases where it does exist, it has not been fully synthesized. This makes it difficult for professionals in ARE and EE to justify or defend their claims about what works (best) using anything other than what Michael Quinn Patton refers to arguments of intrinsic value. In the current atmosphere of accountability, intrinsic arguments carry far less weight than do data based ones.

Second, from a practical perspective, teachers and other educators know that practices (or programs) that work best for one population of learners in one place at one point in time may not be best for another population of learners in another place and/or at another time. This view is embedded in much of the qualitative research in education (e.g., field and case studies). Even in quantitative research, researchers concede this point when they indicate that some practices are more robust or generalizable than others (i.e., there is a narrower or wider range of populations and settings in which practices are determined to be useful). It takes a substantial amount of research, development, and evaluation work on a given practice to support claims that it has, in fact, been found to be useful for a variety of populations in a variety of setting (e.g., the extensive body of work and research on cooperative learning). Few practices (or programs) in EE have received this kind of systematic attention. For this reason, it is noteworthy that the professional educators associated with the program featured in this paper have worked hard to address these needs and concerns for more than 25 years.

Further, the terms standard practice and sound practice have been used in a variety of ways. For example, standard practice can refer to the standardization of a given practice for the sake of consistency from place-to-place and time-to-time (i.e., from a technical perspective). In this sense, a practice may or may not have either an evaluation or a research base that support its use. To overcome this weakness, Holsman (2001) defines standard practice in a narrower sense: "Standard practices are hereby defined as 'those teaching or educa-

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tional strategies which appear to yield desired outcomes if applied under a certain set of conditions, and with age appropriate audiences as demonstrated by research and evaluation." Similarly, for the purposes of this paper, I will define sound practice as meeting two criteria implicit in this discussion: (a) from a practical perspective, a program may be considered sound if its design, delivery, and evaluation work well to help learners accomplish specified goals and objectives; and (b) from a research and evaluation perspective, a program may be considered sound if there is a well developed body of evidence to document and support (a). Thus, Holsman's definition of standard practice and this definition of sound practice appear to address similar criteria and concerns.

Given the apparent disadvantages of "best practices," I will close by indicating a preference for either "standard practices" or "sound practices" as defined above. Both terms, as defined, suggest that a practice (or program) has been clearly defined, refined through repeated delivery, and supported by a substantial body of evidence. Still, both terms leave unanswered important questions regarding the extent to which any practice (or program) can be generalized to new populations and settings; these questions should always be open to scrutiny. I believe that the ideas expressed in this preface are important for those involved in boating, fishing and stewardship education, and leave it to readers to consider them as they read this paper and document.

Model Used to Organize and Illustrate This Paper

The purpose of this paper is to summarize a particular Environmental Education (EE) program. Unfortunately, this purpose and the format of this document do not permit me to adequately present this program. The best way to do that would be to arrange for readers to become involved in or to directly observe training sessions and classroom implementation, or perhaps to view any number of taped workshop and classroom segments. Consequently, other approaches must be used to summarize this program. The two that are most common in the literature and that will be used throughout this paper are narrative summaries and graphic organizers. An attempt will be made to enrich these with the use of quotes and selected samples from program-related materials, studies, and articles.

The graphic organizer or model that I have used to organize this paper and will use to illustrate this program must be described in some detail (Figure 1). Dr. R. Ben Peyton of the Department of Fisheries and Wildlife at Michigan State University presented an earlier version of this model in his work with Aquatic Resource Education (ARE) programs in Northeast and Mid-Atlantic states. He used that version of this model to help State ARE Coordinators explore the distinctions between "Outcomes" and "Benefits," and the common tendency for program administrators to select ARE program "Tools" before determining ARE program "Purposes." Since 1997, I have evolved the version of the model that now appears in Figure 1.

A number of factors have contributed to the graphic model that appears in Figure 1, notably advances in the field of program evaluation: (a) where there is an increasing use of the terms "Outputs," "Outcomes," and "Impacts" to distinguish among different kinds of program results (Rossi, Freeman and Lipsey 1999); and (b) where this is increasing interest in and attention to logic modeling to graphically depict key assumptions about and features of programs that have evolved a theory and evidence base (McLaughlin and Jordan 1999; Rossi, Freeman and Lipsey 1999; Rogers 2000). A brief description of these should help readers better understand the nature of the graphic model in Figure 1.

Outputs, Outcomes, and Impacts

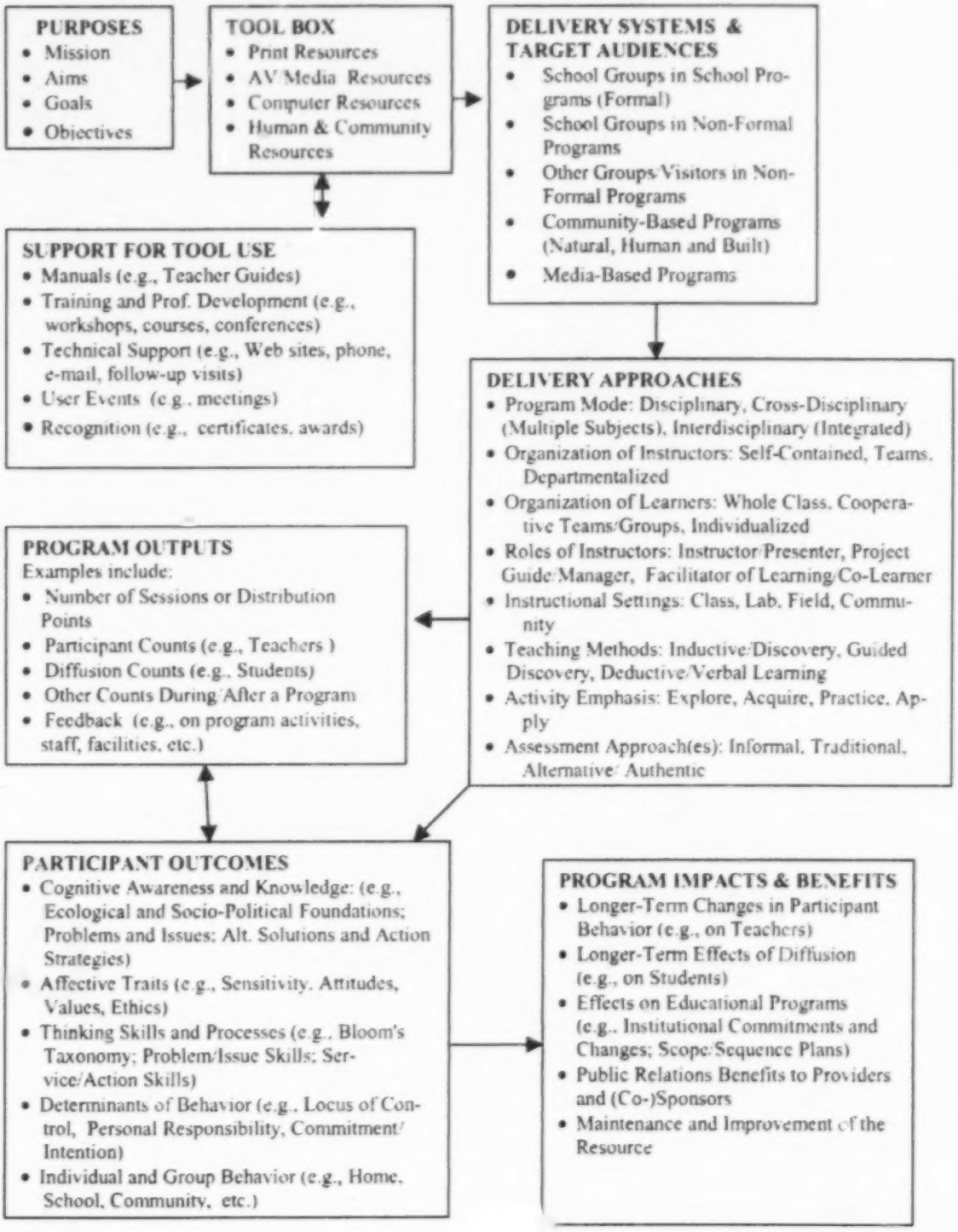
Allow me to describe how the three terms from (a) above are used with respect to the model in Figure 1. To begin, Rossi, et al. (1999) describe the difference between outputs and outcomes.

> In particular, performance measurement schemes distinguish program outcomes from program outputs. Program outputs are the products or services delivered to program participants or other such activities viewed as part of the program's contribution to society. Measures of output, for example, would relate to such things as the number of clients served, the number of service units provided, costs per service unit, the quality of services provided, the nature and volume of advocacy or promotional efforts made by the program, and so forth. (pp. 201-202, underlining added)

Thus, outputs refer to: (a) number counts associated with the delivery of a program, such as those traditionally requested by federal and state agencies; and (b) the quality of the delivered program, as is traditionally determined through formal and informal feedback mechanisms (e.g., satisfaction surveys).

In contrast, Rossi, et al. (1999, p. 202) describe outcomes as the more immediate results of program activity

Figure 1 – A General Logic Model for Resource Education Programs


PURPOSES
• Mission
• Aims
• Goals
• Objectives
TOOL BOX
• Print Resources
• AV Media Resources
• Computer Resources
• Human & Community Resources
DELIVERY SYSTEMS & TARGET AUDIENCES
• School Groups in School Programs (Formal)
• School Groups in Non-Formal Programs
• Other Groups/Visitors in Non-Formal Programs
• Community-Based Programs (Natural, Human and Built)
• Media-Based Programs
SUPPORT FOR TOOL USE
• Manuals (e.g., Teacher Guides)
• Training and Prof. Development (e.g., workshops, courses, conferences)
• Technical Support (e.g., Web sites, phone, e-mail, follow-up visits)
• User Events (e.g., meetings)
• Recognition (e.g., certificates, awards)
DELIVERY APPROACHES
• Program Mode: Disciplinary, Cross-Disciplinary (Multiple Subjects), Interdisciplinary (Integrated)
• Organization of Instructors: Self-Contained, Teams, Departmentalized
• Organization of Learners: Whole Class, Cooperative Teams/Groups, Individualized
• Roles of Instructors: Instructor/Presenter, Project Guide/Manager, Facilitator of Learning/Co-Learner
• Instructional Settings: Class, Lab, Field, Community
• Teaching Methods: Inductive/Discovery, Guided Discovery, Deductive/Verbal Learning
• Activity Emphasis: Explore, Acquire, Practice, Apply
• Assessment Approach(es): Informal, Traditional, Alternative/ Authentic
PROGRAM OUTPUTS
Examples include:
• Number of Sessions or Distribution Points
• Participant Counts (e.g., Teachers)
• Diffusion Counts (e.g., Students)
• Other Counts During/After a Program
• Feedback (e.g., on program activities, staff, facilities, etc.)
PARTICIPANT OUTCOMES
• Cognitive Awareness and Knowledge: (e.g., Ecological and Socio-Political Foundations; Problems and Issues; Alt. Solutions and Action Strategies)
• Affective Traits (e.g., Sensitivity, Attitudes, Values, Ethics)
• Thinking Skills and Processes (e.g., Bloom's Taxonomy; Problem/Issue Skills; Service/Action Skills)
• Determinants of Behavior (e.g., Locus of Control, Personal Responsibility, Commitment/ Intention)
• Individual and Group Behavior (e.g., Home, School, Community, etc.)
PROGRAM IMPACTS & BENEFITS
• Longer-Term Changes in Participant Behavior (e.g., on Teachers)
• Longer-Term Effects of Diffusion (e.g., on Students)
• Effects on Educational Programs (e.g., Institutional Commitments and Changes; Scope/Sequence Plans)
• Public Relations Benefits to Providers and (Co-)Sponsors
• Maintenance and Improvement of the Resource

ties, described in terms of the effects of these activities on program participants (e.g., increased awareness and skill). For educational programs such as ARE and EE programs, outcomes refers to the more immediate learning outcomes in the cognitive, affective, psychomotor, and/or behavioral domains that may be observed at the end of a program (e.g., gains related to any of the Tbilisi Objectives; Unesco, 1977). The measurement of outcomes is typically referred to as the assessment of learning or of learning outcomes (Iozzi, Laveault, and Marcinkowski 1990).

Lastly, Rossi, et al. (1999), describe impacts as part of their discussion of program impact theory.

> The central premise of any social [or environmental] program is that the service it delivers to the target population induces some change that improves social [or environmental] conditions. The program impact theory is the set of assumptions embodied in the program about how its services actuate or facilitate the intended change. Program impact theory, therefore, is causal theory: It describes a cause-and-effect sequence in which certain program activities are the instigating causes and certain social [or environmental] benefits are the effects they eventually produce. (p. 102)

Given this, impacts may be defined as longer-term effects or benefits that result from the activities in a particular program (e.g., long-term effects on program participants, tangible benefits to educational programs and providers). The measurement of impacts is sometimes referred to as impact assessment or impact evaluation. For example, with respect to ARE and EE programs, longer-term, cumulative effects may accrue from learners' repeated exposure to natural environments through recreational activities such as canoeing and fishing (Sward and Marcinkowski 2001). Similarly, benefits of teacher in-service programs may extend from teacher-participants to the schools or programs in which they work (e.g., longer-term curricular change), and in some instances even to the natural environment (e.g., resource stewardship).

Program Logic and Logic Models

The ability to tie a particular set of program activities to learning outcomes and then to longer-term impacts in a convincing cause-and-effect manner requires a substantial amount of work to link theory, research, practice, and evaluation. Attempts by program evaluators to do so for a particular program lead to what they call program theory or program logic for that program.

> A critical aspect of program theory is how the various steps and functions [of a program] relate to each other. Sometimes those relationships involve only the temporal sequencing of key program activities and their effects ... In other cases, these relationships have to do with activities or events that must be coordinated ... Other relationships entail logical or conceptual linkages, especially those represented in program impact theory.... Describing program theory, therefore, requires an understanding of how different events, persons, functions, and other elements represented in the theory are presumed to be related. (Rossi et al. 1999, pp. 171-172).

In evolving their ideas about program theory and program logic, some program evaluators have come to view programs from a systems theory perspective (i.e., as consisting of inputs, throughputs, and outputs). For any given program, they work to identify necessary inputs (e.g., people, resources, internal and outside factors), throughputs (e.g., program activities), and their relationship to desired outputs (i.e., as described above, as outputs, outcomes, and impacts). As they identify these elements and relationships, they construct and make explicit the logic within that program. They refer to the set of established, apparent, and hypothesized relationships among these elements as program logic.

More specifically, Funnell (1997, as cited in Rossi et al. 1999, p.172), McLaughlin and Jordan (1999), Rogers (2000), and others have described the elements and relationships that are central to program logic. Funnell (1997) identified the first of these as the cause-and-effect hierarchy of desired program outputs that lead to immediate outcomes, and in turn to longer-term impacts. Other central features of program logic identified by these writers include: factors internal and external to a program and program activities that are likely to influence these outcomes/impacts, means for defining and measuring these outcomes/impacts, actual program performance data pertaining to these outcomes/impacts, and means for interpreting these performance data.

The graphic depiction of these elements and the relationships for a given program is commonly referred to as a logic model.

> A rather common way of depicting the organizational plan [or logic] of a program is in terms of inputs, representing the resources and constraints applicable to the program, and activities, indicating the services the program is expected to provide.

> When included in a full logic model, these schemes typically represent receipt of services ... as program outputs, which, in turn, are related to desired outcomes. (Rossi et al. 1999, p. 111).

In addition to serving as communication devices, logic models may also serve as heuristic devices; that is, they allowing and even encourage a variety of questions inherent in program logic and program evaluation to be raised and addressed. Rossi et al. (1999) identify a number of questions that may be posed as part of a review of the logic and plausibility of a program:

- Are the program goals and objectives well defined?
- Are the program goals and objectives feasible; i.e., is it reasonable to assume that they can actually be attained as a result of program action?
- Is the change process presumed in the program theory plausible?
- Are the program procedures for identifying members of the target population, delivering service to them, and sustaining that service through completion well defined and sufficient?
- Are the constituent components, activities, and functions of the program well defined and sufficient?
- Are the resources allocated to the program and its various components and activities adequate? (pp. 178-180)

Use of Logic Models in This Paper

I will use the term logic model in two related ways. First, I will refer to the graphic depiction of elements and relationships in Figure 1 as a general logic model. As a general model, it reflects common features of educational programs in the U.S., but does not include all elements central to program logic and logic modeling (e.g., factors internal and external to a given program). The elements of this general logic model are:

- Educational Purposes, which includes aims, goals and objectives;
- Educational Tools, which includes curricular materials;
- Support Systems for Use of Those Tools: which includes manuals, training, and technical support;
- Delivery Systems, which includes sectors and target audiences;
- Delivery Strategies, which includes the means and methods used to deliver education and information programs and activities;
- Outputs, which are program-related number counts and feedback;
- Outcomes, which are learning outcomes for program participants;
- Benefits or Impacts, which are longer-term program payoffs.

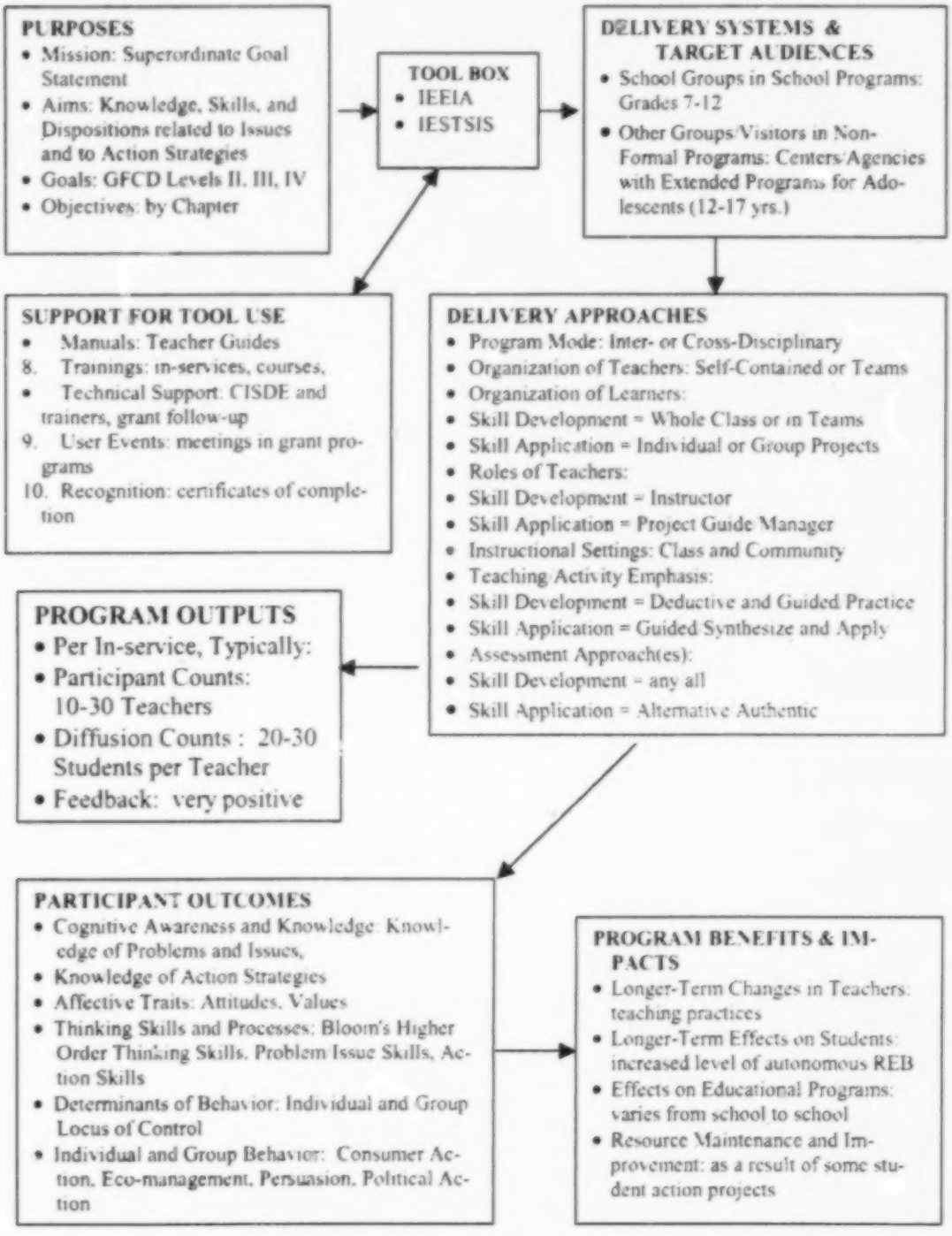
Second, I will refer to the graphic depictions of the EE program featured in this paper as program-specific logic models (Figure 2 and Figure 3). The use of general and program-specific logic models should help to make explicit the evolving logic inherent in this program, and allow it to be compared to other programs in the fields of ARE and EE.

Introduction to the Program Featured in This Paper

This paper will summarize a program directly related to the stewardship emphasis of this document. This program is the issue and action instruction program developed by Dr. Harold Hungerford and his colleagues affiliated with Southern Illinois University at Carbondale (SIU-C) and, more recently, the Center for Instruction, Staff Development, and Evaluation (CISDE). The initial curriculum they have been evolving since 1973 is now entitled Investigating and Evaluating Environmental Issues and Actions (IEEIA) (Hungerford, Litherland, Peyton, Ramsey, & Volk 1988, 1990, 1992, 1996). This and related curricula will be described in a section of this paper entitled "Issue and Action Instruction Curricular Materials."

These curricular materials have been designed for use in formal school programs, although some of them have been adapted for use in non-formal programs (e.g., extended summer programs offered by an environmental center; see Jordan, Hungerford and Tomera, 1986). With respect to their target audience, the original issue and action materials were designed for use at the middle/junior high level. As will be described later, this curriculum was permutated for use in upper elementary grades (i.e., as "extended case studies"), and most recently for use at the secondary level. Under "Delivery System" (Figure 1), these are the audiences within the formal and non-formal sector targeted by this program.

Figure 2. A Program-Specific Logic Model for IEEIA and IESTSIS


PURPOSES
• Mission: Superordinate Goal Statement
• Aims: Knowledge, Skills, and Dispositions related to Issues and to Action Strategies
• Goals: GFCD Levels II, III, IV
• Objectives: by Chapter
TOOL BOX
• IEEIA
• IESTSIS
DELIVERY SYSTEMS & TARGET AUDIENCES
• School Groups in School Programs: Grades 7-12
• Other Groups/Visitors in Non-Formal Programs: Centers/Agencies with Extended Programs for Adolescents (12-17 yrs.)
SUPPORT FOR TOOL USE
• Manuals: Teacher Guides
8. Trainings: in-services, courses,
• Technical Support: CISDE and trainers, grant follow-up
9. User Events: meetings in grant programs
10. Recognition: certificates of completion
DELIVERY APPROACHES
• Program Mode: Inter- or Cross-Disciplinary
• Organization of Teachers: Self-Contained or Teams
• Organization of Learners:
• Skill Development = Whole Class or in Teams
• Skill Application = Individual or Group Projects
• Roles of Teachers:
• Skill Development = Instructor
• Skill Application = Project Guide Manager
• Instructional Settings: Class and Community
• Teaching/Activity Emphasis:
• Skill Development = Deductive and Guided Practice
• Skill Application = Guided Synthesize and Apply
• Assessment Approach(es):
• Skill Development = any all
• Skill Application = Alternative Authentic
PROGRAM OUTPUTS
• Per In-service, Typically:
• Participant Counts: 10-30 Teachers
• Diffusion Counts : 20-30 Students per Teacher
• Feedback: very positive
PARTICIPANT OUTCOMES
• Cognitive Awareness and Knowledge: Knowledge of Problems and Issues,
• Knowledge of Action Strategies
• Affective Traits: Attitudes, Values
• Thinking Skills and Processes: Bloom's Higher Order Thinking Skills, Problem/Issue Skills, Action Skills
• Determinants of Behavior: Individual and Group Locus of Control
• Individual and Group Behavior: Consumer Action, Eco-management, Persuasion, Political Action
PROGRAM BENEFITS & IMPACTS
• Longer-Term Changes in Teachers: teaching practices
• Longer-Term Effects on Students: increased level of autonomous REB
• Effects on Educational Programs: varies from school to school
• Resource Maintenance and Improvement: as a result of some student action projects

Origins of This Issue and Action Instruction Program

This program and the curricular materials associated with it began in 1972 when Mr. Ralph Litherland, a middle grades science teacher, asked Dr. Harold Hungerford, a science education professor, for assistance. Mr. Litherland was attempting to involve students in multiple sections of his course in investigations of community problems and issues. He found it difficult to facilitate individual investigations for a large number of students without first equipping them with the thinking and inquiry skills to do so. They found that:

> ... middle school students are ill-prepared to research environmental problems using primary or secondary sources of information (or both). Early attempts to provide a learning climate in which normal middle school students could apply their own environmental interests to a research-oriented strategy failed miserably, even under the direction of highly competent instructors. The students simply did not have the skills necessary for a successful interaction with environmental problems. (Hungerford and Litherland 1973a, p. TM-1).

Together they developed a set of skill-oriented, structured modules "to provide those skills so that students of varying abilities can become truly autonomous learners" and to prepare "middle school students to investigate environmental problems in an autonomous manner" (Hungerford & Litherland, 1973a, p. TM-1). The modules comprising this set were:

Module I: Looking into Environmental Problems;
Module II: Using Secondary Sources in Studying Environmental Problems;
Module III: Using Surveys, Questionnaires, and Opinionnaires in Environmental Science;
Module IV: Interpreting Data in Environmental Science.

According to Hungerford and Litherland (1973a, p. TM-1) "They set the scene for research and make provisions for research-no more."

> The first four modules are highly structured - purposefully structured in an attempt to produce a successful learning hierarchy. The fifth module, however, changes the rules completely ... Module V is both a self-paced and individualized learning experience (Hungerford and Litherland 1973a, Preface).

In short, "Module V: Studying an Environmental Problem: It's Your Move," was designed to support students in the type of autonomous research or investigation for which Modules I - IV had been preparing them. Thus, from the earliest days of this program, its developers saw the need for structured skill development as a prerequisite to autonomous skill application. Further, Hungerford and Litherland also ...

> ... hoped that this research [autonomous student investigations of local environmental problems] will set the scene for environmental action on the part of students. If it does, the modules will have been eminently successful - beyond the primary intent of the authors (1973a, p. TM-1).

However, there was little, if any, provision for this in the 1973 and 1975 editions of this curriculum. Clear and careful attention to this did not appear until the 1978 edition. From the outset, the developers also saw the need for program evaluation, and began using evaluation as a tool to both improve this program and articulate its strengths (i.e., validate it).

> During the 1972-73 school year, Modules I, II, III, and V were used with 130 students at Lincoln Junior High in Carbondale, Illinois. Results of that testing have prompted minor revisions of the original materials. Of even greater significance is the observation that interaction with Modules I, II, and III did, in fact, produce a cognitive climate favorable to autonomous research ... many of the students engaged in training and research did, in fact, evaluate their own values toward numerous issues of environmental significance with subsequent revision of those values taking place (Hungerford and Litherland 1973a, p. TM-2).

In addition to well-designed materials and program evaluation, the developers recognized that a third factor would be critical to the success of this program: well-prepared teachers. "Like so many teaching strategies, the success of this modular design depends to a large extent on the teacher" (Hungerford & Litherland, 1973a, p. TM-2). It became apparent to the developers that the shift from the structure of Modules I - IV to the individualized pace of Module V could be problematic for teachers: "The teacher MUST be prepared for this or his/her psyche will be ... traumatized by the shock of going from a highly structured situation into a highly unstructured one" (Hungerford & Litherland, 1973a, Preface). They also realized that some teachers would lack

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the willingness and/or ability to shift from one teaching style and classroom environment to the other. While it would be some years before the developers and their colleagues would evolve a teacher education program and network, the need for it was apparent from the outset.

Overview of The Issue and Action Instruction Program

The primary focus of this program and associated curricula is on the development and application of investigation and evaluation skills to environmental problems and issues, and to alternative solutions and action strategies. As has been described elsewhere (Bardwell, Monroe and Tudor 1994; Ramsey 1998), these materials take a structured approach to the development of these skills, and then encourage the teacher to become a guide and facilitator during skill application. Traditionally, teachers who work with this program approach skill application in the form a project (i.e., for individuals, cooperative groups, or whole classes), and refer to this project as an "issue investigation." These projects require students to sequence and apply the skills they have been developing as they investigate community-based problems and issues. Ideally, these investigation projects lead into and culminate in action plans and projects that target the problems and issues investigated by students. For the most part, this program has been unique in maintaining its primary focus on skill learning, while allowing and encouraging students to engage in content learning on a "just-in-time" basis (i.e., substantial content learning occurs during the aforementioned projects). More will be said about the importance of skill learning in the section of this paper on the "Purposes of This Issue and Action Instruction Program."

As with many outdoor, conservation and environmental education programs (e.g., Hooked on Fishing; Project Learning Tree; Project WILD; Project WET), this program also has evolved a significant teacher preparation component and network of certified trainers. However, there are several important differences between the teacher preparation component for this program and those commonly used elsewhere (e.g., six hour or one day workshops). These differences pertain to the purpose(s), nature, length, and costs of the workshops, as related to (or determined by) the nature of the program and curricula. These differences also will be described in greater detail in the section of this paper entitled "Teacher Preparation for Issue Instruction."

There is an additional way in which this issue and action instruction program is different than most other outdoor, conservation, and environmental education programs (see Disinger 1981; Chenery and Hammerman 1984; Rakow and Lehtonen 1988; Simmons 1991). By the late 1980s and early 1990s, Hungerford and his colleagues had evolved a substantial research and classroom evaluation base to support claims about this program's effectiveness and worth with respect to stewardship behavior. The former will be summarized in the section of the paper entitled "Research Base for This Program," while the latter will be summarized in the section of the paper entitled "Classroom Evaluation Base for This Program." The evolving program theory that links these two elements is reflected in Figures 2 and 3.

Purposes of This Issue and Action Instruction Program

While all issue and action instruction curricula associated with this program feature the same skill development and application sequence, the educational purposes (i.e., mission, aims, goals, and objectives) they serve are broader than that. As suggested by the logic model in Figure 1, to understand this program and these curricula, it is necessary to understand these "Purposes." The broadest statement of purpose will be referred to as a mission statement. Typically, a program's mission statement is a broad philosophical statement about what it hopes to contribute to without any tying that to any particular age or grade level (i.e., as in goals), or any set of activities (i.e., as in objectives). Hungerford, Peyton, and Wilke (1980b) adapted the following super-ordinate goal statement from Harvey's dissertation (1976) to serve as their mission statement:

> The Superordinate goal ... to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment (p. 43).

This statement appears in numerous articles prepared by the developers to describe the purposes of this program (Hungerford and Volk 1984, 1990; Ramsey, Hungerford and Volk 1992). It clearly reflects the role of citizens in resource stewardship and, as such, provides guidance for what the aims, goals, and objectives to be derived from it should address.

The aforementioned articles also articulate the educational goals of this issue and action instruction program. These four goals were drawn directly from Goals for Curriculum Development in Environmental Education (Hungerford, Peyton, and Wilke 1980b) that, in turn, were validated against the Tbilisi objectives (Unesco 1978). These four goals (or goal levels) are:

> Level I. Ecological Foundations: This level seeks to provide the receiver [learner] with sufficient ecological foundations knowledge to permit him/her to eventually make ecologically sound decisions with respect to environmental issues.
>
> Level II. Conceptual Awareness Level - Issues and Values: This level seeks to guide the development of a conceptual awareness of how individual and collective actions may influence the relationship between quality of life and the quality of the environment and, also, how these actions result in environmental issues which must be resolved through investigation, evaluation, values clarification, decision making, and finally, citizen action.
>
> Level III. Investigation and Evaluation Level: This level provides for the development of the knowledge and skills necessary to permit receivers [learners] to investigate environmental issues and evaluate alternative solutions for remediating those issues. Similarly, values are clarified with respect to those issues and alternative solutions.
>
> Level IV. Environmental Action Skill Level - Training and Application: This level seeks to guide the development of those skills necessary for receivers to take positive environmental action for the purpose of achieving and/or maintaining a dynamic equilibrium between quality of life and the quality of the environment (Hungerford, Peyton, and Wilke 1980b, pp. 43-44).

Of these four goal levels, Levels II, III and IV receive substantial attention in all issue and action instruction curricula. In Investigating and Evaluating Environmental Issues and Actions (IEEIA), Level I is not addressed due to the impracticality of providing scientific background on the wide range of environmental problems and issues it introduces. Rather, as was done by Ramsey during his years as a middle level science teacher, teachers using IEEIA are encouraged to teach a unit on ecology beforehand. In some other issue and action instruction curricula, Level I has been expanded beyond "Ecological Foundations" to include the other relevant "Scientific Foundations" that pertain the theme of that curriculum. This will be further clarified in the next section of this paper.

As is common to many, but not all, educational programs and curricular materials, all of the issue and action instruction curricula associated with this program contain instructional objectives. Typically, developers have prepared instructional objectives for each chapter and are found on the first or second page of each chapter in these curricular materials. These objectives were developed and presented to support instructional planning and delivery, as well as assessment (i.e., on a pre-assessment, formative, and/or post-assessment basis). Readers interested in learning more about these instructional objectives are encouraged to review these curricula. The above mission statement, and their associated goals and objectives have guided the development, implementation, and evaluation of all curricular materials associated with this issue and action instruction program.

The only aspect of "Purpose" not addressed above is the educational aims of this program. Aims can be viewed as characteristics to be developed or acquired over a lifetime (i.e., beyond the years of K-12 schooling). In the EE literature, when reference is made to characteristics of an environmentally literate citizen or citizenry, those characteristics can and should be viewed as aims of EE. The goals and objectives of EE programs such as this one should help learners develop or acquire these characteristics (i.e., meet these aims). The mission statement (superordinate goal) noted above introduces several of these aims: knowledgeable, skilled, dedicated, and willing to work. These aims are commonly found in environmental literacy frameworks constructed by the developers (Hungerford and Tomera 1985; Hungerford and Volk 1990) and by others in the field of EE (Simmons 1995; Wilke 1995).

Modern models of environmental literacy have evolved over much of the same time period, as did IEEIA. In part, this was due to the fact that some of the research and evaluation studies associated with this issue and action instruction program helped to shape those models of environmental literacy (e.g., Ramsey 1979, 1989, 1993; Klingler 1980; Hines 1985; Sia 1985; Sivek 1989). Nonetheless, while the components of this evolving model of environmental literacy (aims) were not available to guide the early development of IEEIA, they have guided assessments done as part of classroom evaluation studies, and guided both later revisions of IEEIA and the development of more recent issue and action instruction curricula (see Hungerford, Litherland, Peyton, Ramsey, and Volk 1988, 1990, 1992, 1996; Ramsey, Hungerford, and Volk 1989; Marcinkowski et al. 2000). From the perspective of the general logic model (Figure 1), this is precisely how the developers have built their program-specific logic model: by refining program "Purposes" and "Tools" so that they would be more clearly reflected in program "Outcomes" and "Impacts." Given this, it is appropriate to list here the characteristics of an environmentally literate citizen

viewed as aims of this program (Hungerford, Litherland, Peyton, Ramsey, and Volk 1996, p. 205):

- Environmental sensitivity (i.e., feelings of comfort in and empathy toward natural areas);
- Knowledge of ecological concepts;
- Knowledge of problems and issues;
- Skill in identifying, analyzing, investigating, and evaluating problems and solutions;
- Beliefs and values (i.e., beliefs are what individuals hold to be true, and values are what they hold to be important regarding problems/issues and alternative solutions/action strategies);
- Knowledge of action strategies;
- Skill in using action strategies; and
- Internal Locus of Control (i.e., the belief and/or feeling that working alone or with others, an individual can influence or bring about desired outcomes through her/his actions).

Issue and Action Curricula

According to the general logic model presented in Figure 1, the issue and action curricula to be described below all serve as part of the "Tool Box." What are these tools, and how have they evolved since the 1973 trial edition?

Investigating and Evaluating Environmental Issues and Actions: Skill Development Modules

The previously described trial education was the first in a series of editions of the modules designed to promote development and application of environmental problem-solving skills. In 1973, the developers prepared a revised edition based on the results of the field test (Hungerford & Litherland 1973b). These modules were revised again two years later, in this case with the substantial addition of artwork by then current graduate students (Hungerford and Litherland 1975).

It was not until the later 1970s that these modules saw the first of several expansions. With the assistance of Dr. Audrey Tomera, and insights gleaned from the dissertation work of R. Ben Peyton (1972) in the area of environmental action, the developers expanded these materials to include a new module, "Module VI: Environmental Action Strategies" (Hungerford, Litherland, Peyton, and Tomera 1978). In line with previously mentioned action-oriented aims and goals, the purpose of this module was to provide students with an opportunity to develop conceptual knowledge of and skill with responsible environmental action strategies. Consequently, Module VI addressed four major components of their "Paradigm for Citizen Responsibility": (a) whether specific human actions were positive, negative, or passive with respect the natural environment; (b) five categories of environmental action; (c) different levels at which actions could be taken; and (e) thirteen questions, referred to as action analysis criteria, for evaluating the appropriateness of actions proposed or planned by students (Hungerford and Peyton 1980). At the end of Module VI, students were required to prepare and evaluate plans for an action based upon the findings and recommendations from their investigation, but were not required to carry out that action:

> Your assignment here is NOT to take action, because this is something YOU would have to do AS A CITIZEN. Whether you take action will depend on your values and whether your work in these modules has persuaded that you should become involved ... The final decision is yours to make (Hungerford et al. 1978, p. 166).

The addition of Module VI went a long way toward realizing the hopes offered by Hungerford and Litherland (1973b) noted earlier.

The next edition of the Modules was completed in 1985. By then, the field of EE had experienced a surge of growth and development, all of which influenced this program. Developments during this period included publication of the reports of major conference sponsored by Unesco (Unesco 1977, 1978), completion of dissertations that helped define the field (Harvey 1976; Hart 1980), curriculum goals for EE that drew from and expanded on these sources (Hungerford, Peyton and Wilke 1980b), the first publications of the Research Commission that North American Association for Environmental Education (NAAEE) established in 1980 (Iozzi 1981, 1984), early models of environmental literacy (Hungerford and Peyton 1976; Hungerford and Tomera 1977, 1985) and, finally, seminal dissertation studies on correlates and predictors of responsible environmental behavior (Hines 1985, Sia 1985).

During this same period, Hungerford and Tomera served as major advisors for a series of Masters theses and research projects that served as the first experimental-type evaluation studies of this issue and action instruction program (Ramsey 1979, Klingler 1980, Volk 1980, Childers 1981). Of these authors, Ramsey and Volk went on to make significant contributions to the 1985 edition of this curriculum based on their work in these studies, their classroom experiences with this curriculum, and their involvement in developing other cur-

riculum components (e.g., issue analysis procedures; see Volk 1980, Ramsey, Hungerford and Volk 1989).

With the completion of the 1985 edition, now entitled *Investigating and Evaluating Environmental Issues and Actions* (IEEIA; Hungerford, Litherland, Peyton, Ramsey, Tomera and Volk 1985), this issue and action instruction program was coming of age. This curriculum reflected key aims and goals for the field of EE, and was supported by both positive findings from classroom evaluation studies and a growing body of research pertaining to environmental literacy and behavior. With a sound curriculum and program, questions were raised about how the skill development and application sequence that served as the core of this curriculum and program could be made available to a wider range of students. Two responses to this question were offered in the later 1980s.

Permutations of IEEIA

The first response reflected the developers' involvement in the science education community. In particular, Ramsey pushed for a Science-Technology-Society (STS) application (Hungerford, Volk and Ramsey 1990). The developers did this to address the growth of STS in the 1980s within the science education community, and interest within the STS community in environmental problems and in skill development and application with respect to STS problems (Rubba and Weisenmayer 1988, Coleman 1989, Simpson, McLaughlin, Volk and Hungerford 1989, Ramsey 1993). This STS format generally resembles IEEIA, with the following modifications:

- A new Chapter 1 was added to provide students with sufficient background on the nature of science, technology, and society, and on interactions amongst them;
- The range of problems used in skill development activities was expanded beyond environmental ones to include a wider range of STS problems (e.g., health and biomedical problems, technology-oriented problems such as agriculture and transportation);
- In Chapter 7, the main focus of the chapter was expanded to the solution of STS problems and resolution of STS issues.

As mentioned earlier, a second response was undertaken to allow the skills in IEEIA to be developed and applied by students in lower grades, particularly grades 5-6. In this case, a number of the developers and their colleagues helped prepare what they referred to as the "Extended Case Study" format (e.g., Culen, Simpson, Hungerford, Ramsey and Volk 1988, Ramsey, Hungerford and Volk 1989). This intermediate-level extended case study format has several important features, including:

- It consists of four or five chapters, each of which addresses one goal level from Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b);
- The range of science and environmental content is narrowed to focus on a particular theme of national significance such as solid waste (Ramsey, Hungerford and Volk 1989, 1996), wetlands (Culen 1992), or threatened and endangered animals (Hagengruber and Hungerford 1993; Hungerford, Hagengruber, and Bluhm 1999);
- The skill development sequence is somewhat limited in comparison to IEEIA, allowing more space for the treatment of science and environmental content pertinent to the curriculum's theme; and
- Skill application is commonly undertaken in the context of the curriculum's particular theme, and in the form of whole class or large group investigations (Ramsey and Hungerford 1989).

As was true with IEEIA, several classroom-based evaluation studies of the extended case study format were carried out by developers for their dissertation studies (Simpson 1991, Culen 1996). And, as might be expected in light of positive results, extended case study materials have been both distributed and used in teacher in-service workshops since 1990 so as to provide trained teachers with a wider range of curriculum infusion options.

Lastly, a new experimental version of the extended case study was developed to address new opportunities and pressures in the public school that arose in the 1990s (Marcinkowski, Anderson, Drag, English, Lunsford, & Sward, 2000). This version of the extended case study format is designed for higher rather than lower grade levels (i.e., secondary level and higher). Altered features of this secondary-level extended case study format include:

- The use of a particular geographic region as its focus and theme (i.e., the Greater Everglades Watershed);
- This theme allows the chapter on science/ecological foundations to focus on the natural history and ecology of this region;
- This theme allows for a wider range of region-specific problems to be addressed than is typically found in intermediate-level extended case studies;
- While keeping the more detailed skill development sequence of IEEIA intact, more theme-related subject matter has been added to provide students with a stronger content background (i.e., in light of the

complexity of problems and restoration efforts within this watershed) and to provide greater coverage of national and state standards that now drive school curricula;
- Because both subject matter and skills vary from chapter-to-chapter, a sample issue investigation was added as a model.

Much work remains to determine if this secondary-level extended case study format will be as effective as its predecessors.

Teacher Preparation for Issue and Action Instruction

The preparation of teachers to effectively use curricula is a central concern of virtually all EE programs. Materials have been prepared to support these efforts (Wilke, Peyton, and Hungerford 1987; Hungerford, Volk, Dixon, Marcinkowski and Sia 1988; Marcinkowski, Volk and Hungerford 1990; Simmons 2000). Due to its importance, a separate component that includes teacher preparation and other forms of teacher support, "Support for Tool Use," appears in the general logic model (Figure 1). One may apply the general logic model to teacher preparation programs just as I am applying it here to a K-12 program. In this case, the "Purpose" and "Outcome" of teacher preparation would be their understanding of and ability to effectively use issue and action curricula, and the "Tools" are those curricula. The target audience consists of practicing teachers in grades 6-12 and higher, and other interested education personnel. There are several "Delivery Systems" and "Delivery Strategies" for this type of teacher preparation, as will be described below.

Crucial Delivery Strategies for Teacher Preparation

As with most ARE and EE programs, teacher preparation programs for issue and action instruction have evolved over time. Due to the nature of the skill development and application sequence inherent in all issue and action curricula, the preparation of teachers to effectively use these curricula is substantially different than for many other nationally-available ARE and EE programs. The following have become common features of virtually all efforts to prepare teachers to effectively use the issue and action curricula described earlier (see Figure 2 and Figure 3).

First, teacher preparation programs must be longer in duration. This is, at least in part, due to the fact that few teachers have learned these skills, much less how to apply them or even teach them, during their pre-service training (Peyton 1978, Peyton and Hungerford 1980, McKeown-Ice 1995). For many years, the average length of teacher in-service workshops in this program was two weeks (i.e., 10-12 days). When funding was made available from larger grant sources (e.g., NSF, U.S. Department of Education's National Diffusion Network), summer workshops lasted as long as 3-4 weeks. Over the last few years, in response to concerns about length, Hungerford, program developers, and other certified trainers have designed and run workshops lasting one week.

Second, because the focus of this program was on skill development and application, and the general use of these materials requires a rather lengthy instructional sequence, the nature of this teacher preparation was different (i.e., it could not and did not rely on the use of a set of largely unrelated activities). From the outset, Hungerford and his colleagues took the position that all teacher preparation programs should model both the skill development and the skill application process. The former helps to familiarize teachers with the skills, the curricular material, and teaching methods appropriate for the teaching/learning of skills. The latter requires that teachers, usually in small groups, become familiar with skill application, the project sequence, and methods for facilitating these projects. By the end of each teacher workshop, all teacher-participants are familiar with these skills and have reported out their own issue investigation project.

Third, due to difficulties teachers often encounter in infusing or inserting an issue and action curriculum into her/his school program, in implementing (teaching from) that curriculum, and in appropriately guiding projects and assessing student learning, support for these teachers is almost always needed after in-services have been completed. This can take several forms: (a) encouragement to teachers to use Teachers Guides that accompany all issue and action curricula; (b) technical support through the workshop providers and/or material developers (e.g., CISDE); and (c) follow-up visits to teachers in their classrooms. Because no one of these was sufficient unto itself, the developers have relied upon a combination of all of these, particularly when time and funding permitted.

Fourth, due to the duration of these workshops and the need for follow-up, they tend to be more costly to run. Usually two or even three certified trainers oversee each workshop, raising salary and travel support costs. Teacher-participants are usually provided with housing and meals for the duration of the workshop, as well as travel support to get to and from the workshop site. Follow-up visits often require additional funding for staff time and travel costs. Nonetheless, Hungerford and his colleagues would argue that cost should not be the primary determinant of workshop length or follow-up (i.e., as may be argued from an output or cost/benefit perspec-

tive), because the benefits to teachers and, through them, to their students, exceed those possible in shorter workshops and without such follow-up. Given this, grant programs have become likely sources for this kind and level of support.

Viable Delivery Systems for Teacher Preparation

Because the above features are critical conditions to prepare teachers to effectively use issue and action curricula, there were three viable options to prepare teachers to effectively use them. First, in the 1970s, Hungerford and Tomera taught this skill development and application sequence in the form of a graduate-level EE course. Virtually all of the individuals cited in this paper as additional curriculum developers, authors of research studies, and authors of classroom-evaluation studies received their initial training in this manner. Many of these former Southern Illinois University graduate students have gone on to teach in other universities and to offer graduate-level issue and action instruction courses of this kind.

A second option was to offer issue and action instruction training in the form of an undergraduate course for pre-service teachers. It is noteworthy that such an issue and action methods course has been offered as a required science methods course at Southern Illinois University since 1989. Unfortunately, this appears to be the only university in the U.S. in which an issue and action course is included in a pre-service teacher education program as either a required or an elective course (McKeown-Ice 1995; T. Volk, personal communication, March 9, 2001).

Due to above-mentioned limitations in pre-service teacher education programs, the third option for preparing teachers is the most widely used in the field of EE: teacher in-service workshops. Since the early 1980s, the developers have obtained funding through State Eisenhower Funds and other sources to run in-service regional workshops in Illinois and other midwestern states. Once the 1985 edition of IEEIA was completed, efforts to obtain grants through federal agencies for these in-service trainings were particularly successful. Between 1985 and 1994, the developers obtained no less than seven grants through the National Science Foundation, allowing in-service workshops to be provided for teachers from Midwestern, Mid-Atlantic, and Southern states. These grants supported lengthy trainings and periodic follow-up efforts, and required substantial assessment and evaluation efforts. Data from these grant programs, coupled with data from classroom evaluation studies, were sufficient to permit IEEIA to be adopted onto the U.S. Department of Education's National Diffusion Network (NDN) in 1990, and the STS version to be adopted a year later. Through NDN, the developers garnered several years of support for material dissemination and teacher in-service workshops. Lastly, as a result of the growing credibility of this issue and action instruction program, several of the developers were approached by Kraft Foods to prepare a solid waste curriculum (Hungerford, Volk and Ramsey 1992, 1993) and to provide in-service training to selected teachers.

Collectively, the in-service workshops funded by private sources, and state and federal agencies allowed the developers to build a national network of 33 nationally certified IEEIA trainers and a larger cadre of district-level trainers in at least 13 states. On a national scale, trainers in this network are responsible for almost all of the program-related teacher preparation associated with the above three options.

Research Base for This Issue and Action Program

The research base for a particular program is important with respect to the general logic model even though there is no separate element for it (Figure 1). This is because research provides empirical evidence about the relationships between two or more of the model's elements. As noted earlier, the relationship of "Impacts" to other features of a logic model is of central importance, and therefore will be given primary attention in this section. As professionals associated with a particular program accumulate research evidence regarding the relationships between "Impacts" and other model elements, they may use that evidence to evolve a program theory for that program.

The theory and research base for any education program may draw upon research carried out by professionals related to that program, as well as upon the literature in related fields. This has been true for this issue and action instruction program. Its developers have relied upon their own studies (Hungerford, 1988; Hungerford, Volk and Ramsey 2000), research in EE (Iozzi 1981, 1984), and research in other fields (Hines 1985) as they evolved and refined their program. It is highly significant that, over the past two decades, the developers and their colleagues have come to recognize that the "program theory" that underpins and drives a good bit of ARE and EE practice is not supported by this research.

The Knowledge-Attitude-Behavior Model

The most popular program theory operating in EE and, quite possibly ARE, is known as the knowledge-attitude-behavior (KAB) model. The kinds of behavior (B) of interest here are the wide range of stewardship behaviors that are collectively known as Responsible Environmental Behavior (REB). Unfortunately, the

growing body of research about REB both within and outside the field of EE clearly demonstrates that this is an overly simplistic model: the K-A-B relationships are neither direct nor linear, and there are more variables and phases involved in the process of forming or shaping REB. As a result, this model has been critiqued by Peyton (1981), Sia (1985), Hines (1985), Marcinkowski (1989), Hungerford and Volk (1990), and Simmons (1991).

What kinds of theoretical assumptions are reflected in the KAB model? Hungerford and Volk (1990, p. 9) quote Ramsey and Rickson (1976, p. 10) as indicating that "increased knowledge leads to favorable attitudes ... which in turn lead to action promoting better environmental quality" (emphases added). Marcinkowski (1989, p. 95) offered a similar quote from Birch and Schwaab (1983, p. 30) to further illustrate the logic of this model:

> As previous research indicates ... the assumption must be made that informed attitudes will lead to subsequent water conservation behavior ... Further research should attempt to offer empirical evidence that knowledge and attitude gains resulting from the water conservation unit will influence a student's behavior regarding efficient water use" (emphases added).

Finally, in analyzing the goals of 1,225 nature and environmental centers, Simmons (1991) reported that about two-thirds of the responding centers identified goals which reflected knowledge-behavior and/or K-A-B models. These anecdotes provide some insight into the nature and pervasiveness of K-A-B thinking in the field.

Iozzi (1981, 1984), Hines (1985), and others have reported that attitude is by far the most commonly studied variable in EE, a circumstance which both reflect the pervasiveness of thinking about the role of attitudes (i.e., within the K-A-B model). They have also provided the research evidence to assess and critique this role. With respect to the knowledge-attitude (K-A) portion of the K-A-B model, Peyton (1981) presented a review of 21 studies that investigated these relationships. His review, and Marcinkowski's subsequent research review (1989, pp. 94-97), revealed a more complex relationship between knowledge and attitude than is implied in the K-A-B model. Research evidence indicates that: (a) the strength of the K-A relationship is contingent upon the particular dimension(s) of knowledge and attitude of interest; and (b) even when these are well matched, this relationship may be non-linear and can change over time. Similarly, reviews of research on the attitude-behavior (A-B) relationship (Sia 1985, pp. 66-67; Marcinkowski 1989, pp. 97-101) indicated that: (a) as with K-A, the strength of the A-B relationship is contingent upon the dimension(s) of both attitude and behavior; (b) the strength of this relationship also appears to be contingent upon or an artifact of measurement conditions; and (c) while attitude is one of several variables influencing behavior, there appear to be other variables which may moderate or influence the attitude-behavior relationship.

Evidence to support critiques of the K-A-B model can be found in other bodies of research, including Fishbein and Ajzen's work (1975, 1977) and research in the "diffusion-adoption" tradition (Rogers, 1995). Rogers reported that "KAP studies are sample surveys of knowledge (K), attitudes (A), and adoption of the practice (P) of family planning innovations ... [M]ost national family planning programs have found it much easier to diffuse knowledge about contraceptive methods (K) and to achieve favorable attitudes toward family planning (A), than to secure the widespread adoption and practice of contraception (P) by the target audience. Thus, KAP surveys often find a 'KAP-gap' with a relatively high percentage of knowledge and favorable attitudes toward family planning methods ... but a relatively low rate of adoption ... Knowledge gain and attitude change can be achieved more easily than can adoption of family planning methods" (1995, pp. 70-71; emphases added). Reviews of the research literature within and outside the field have clearly indicated the K-A-B model was a faulty and inadequate program theory to guide EE practice. If REB is to given more than lip service, a more adequate knowledge base had to be constructed through research to inform and guide practice.

Evolving Research Base for This Issue and Action Program

Over the past two decades, the developers of this program have made a concerted effort to summarize and synthesize research that has a bearing on this program (Hines and Hungerford 1984, Hines 1985, Hungerford 1988, Hungerford and Volk 1990, Volk and McBeth 1997, Marcinkowski 1998, Hungerford, Volk and Ramsey 2000).

Of these research documents, three made noteworthy contributions to the research base and program theory underlying this program. The first of these is the dissertation study by Hines (Hines 1985; Hines, Hungerford and Tomera 1986/87). While this was not the first attempt to summarize or synthesize the research on variables related to REB (see Lipsey 1977; Cook and Berrenberg 1981; Hines and Hungerford 1984), it is the most recent and remains the only quantitative synthesis or meta-analysis of research in the area of REB and in the field of EE. Following traditional meta-analysis procedures, she reviewed studies on REB from a variety of

fields and used statistical procedures to determine the strength of relationship between REB and associated variables. The core of her findings is presented in Table 1.

These findings provided evidence that knowledge and attitude were not as strongly correlated to REB as implied in the KAB model, and identified at least three other variables missing from that model: verbal commitment (or willingness, intention), locus of control, and personal responsibility.

Table 1. Summary of Hines' Meta-Analysis Results for Descriptive Studies

Variable	Corrected correlation coefficient	Corrected standard deviation	Number of values based on
Verbal commitment	.491	.130	6
Locus of control	.365	.121	4
Attitude	.347	.224	51
Personal responsibility	.328	.121	6
Knowledge	.299	.195	17
Education level	.185	.122	11
Income	.162	.084	10
Economic Orientation	.160	.118	6
Age	-.151	.200	10
Gender	.075	.084	4

Note: Several studies reported data on more than one variable.

During the same time that Hines was carrying out her study, a fellow graduate student was carrying out a different kind of investigation of variables related to REB. Sia (1985; Sia, Hungerford and Tomera, 1985/86) had begun to explore predictors of REB, drawing on Hines' work, the results of prior prediction studies and a working model of environmental literacy prepared by the developers (Hungerford and Tomera 1977; 1985). Several things about his study and results are noteworthy. First, he was one of the first to investigate more than one or two predictor variables; i.e., he investigated eight. Second, of these eight, six were significantly correlated to REB ($r = -.39$ to $.56$; $p<.05$): (1) environmental sensitivity; (2 and 3) knowledge of and skill in using environmental action strategies; (4 and 5) individual and group locus of control; and (6) psychological gender role (Sia et al. 1985/86, p. 37). Two of these variables lie at the heart of this issue and action program (i.e., 2 and 3), while two others were identified by Hines and are also positively influenced by this program (i.e., 4 and 5). Third, the results of his final stepwise regression analysis (Table 2) indicated that skill in using action strategies, environmental sensitivity, and knowledge of action strategies accounted for the majority of the variance (or variability) in REB scores (i.e., 49.24% of 51.25%).

Table 2 – Results of Sia's Stepwise Regression Analyses for the Total Sample (n=171)

Predictor Variables	R-Square Values	% Explained Variance	F	P
Perceived skill in using env. action (df = 1, 169)	.3454	34.54%	89.16	.0001
Level of env. sensitivity (df = 2, 168)	.1292	47.46%	41.31	.0001
Perceived knowl. of env. action (df = 3, 167)	.0178	49.24%	5.87	.0165
Belief in/attitude toward technology (df = 4, 166)	.0097	50.21%	3.24	.0737
Psychological sex role classification (df = 7, 163)	.0093	51.14%	3.14	.0784
Belief in/attitude toward pollution (df = 8, 162)	.0057	51.71%	1.92	.1673
Perceived indiv. locus of control (df = 9, 161)	.0036	52.07%	1.25	.2649
Perceived group locus of control (df = 10, 160)	.0008	52.15%	0.24	.6261

Sia's study was replicated by Sivek (1989; Sivek and Hungerford 1989/90), and replicated and extended by Marcinkowski (1989). Both studies corroborated the importance of Sia's top three variables as predictors of REB. Of particular relevance to this issue and action instruction program are the results from all three studies

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Table 3. Summary of Stepwise Regression Results Regarding the Relative Ordering and Contribution to Explained Variance in REB for Knowledge of Action and Skill in Using Action

Study	Samples	Know. of Action Entry Order	Know. of Action R-square Value	Skill in Action Entry Order	Skill in Action R-square Value
Sia (1985)	Total	3rd	1.8%	1st	4.5%
	Sierra Club	3rd	1.1%	1st	30.1%
Sivek (1989)	Total	6th	.03%	1st	18.6%
	WI Trapper's Assoc.	7th	.02%	1st	28.1%
	Ducks Unlimited	5th	1.21%	1st	15.4%
	Trout Unlimited	4th	2.12%	1st	11.1%
Marcinkowski (1989)	Total	1st	19.3%	4th	5.3%

pertaining to knowledge of and skill in using action strategies. These results were summarized by Marcinkowski (1998, p. 249), and are presented in Table 3. In all three studies, and for all samples (separate and combined), one of these two variables served as the strongest predictor of REB. This either/or finding reflects the fact that the relationship between these two variables for Sia's sample (1985), Sivek's (1989) samples and subsamples, and Marcinkowski's (1989) sample were statistically significant in all cases (i.e., ranging from a low of r=.72 for Sivek's Trout Unlimited sample, to a high of r=.87 for Sivek's Wisconsin Trapper's Association sample).

Lierman (1995) carried out one of the few studies of predictors of REB using a sample of high school students. Her data (n=436) had been collected during the pilot test of the Secondary School Environmental Literacy Instrument (SSELI; Marcinkowski and Rehrig 1995, Wilke 1995). The SSELI included comparable measures for Sia's top five predictor variables and for REB. From Lierman's stepwise regression analysis of the full range of measured variables, she found skill in using environmental action strategies to be the strongest predictor of REB for these students, followed by willingness to act (as in Hines 1985) and issue identification skills (as in Volk 1980). These results provide evidence that there is an important link between variables found to serve as correlates and predictors of REB and the variables that are featured as aims of this program.

Hungerford and Volk (1990) conducted the third of the aforementioned research reviews as they prepared an invited paper. In this case, Hungerford and Volk did not collect their own data or rely on their own statistical analyses. Rather, they relied on prior reviews of research on REB. From their careful analysis of this literature, they generated a model of variables that were related to behavior (Table 4).

Table 4. Variables Included in Hungerford and Volk's (1990) Model

Stage	Major Variables	Minor Variables
A. Entry	Environmental sensitivity	Knowledge of ecology Androgyny (psychological gender role) Attitudes toward pollution, technology, and economics
B. Ownership	In-depth knowledge of issues Personal Investment in issues and environment	Knowledge of consequences of behavior (+ and -) Personal commitment to issue resolution
C. Empowerment	Knowledge of and skill in using action strategies Locus of Control Intention to act	In-depth knowledge of issues

For the purposes of this paper, three things are noteworthy about the variables included in Hungerford and Volk's model (Table 4):

1. The model contains all major variables identified in Hines' (1985) meta-analysis, as well as in prediction studies by Sia (1985), Sivek (1989), Marcinkowski (1989) and Lierman (1995). These appear to be stable and significant attributes of adults active in conservation and/or environmental pursuits and, to a lesser extent, of adolescents;

2. Most of these variables are found in modern environmental literacy frameworks (Simmons 1995, Wilke 1995), and therefore also serve as aims of EE ("Purposes" in Figure 1); and

3. Most of these variables are emphasized in this issue and action instruction program, and evaluation studies have found that they are influenced to a significant degree by this program.

The model summarized in Table 4 serves as the core of the program theory for this issue and action program, and represents a significant departure from the popular but ineffective KAB model. The extent to which these correlates and predictors of REB can be influenced by this issue and action instruction program will be summarized in the next section.

Evaluations of This Issue and Action Instruction Program

As presented in Figure 1 and as discussed earlier, "Outcomes" is a central element of any logic model. Michael Quinn Patton suggests that without evidence of program's outcomes, a program is often left to justify its worth using arguments based on intrinsic values (e.g., tradition, popularity, etc.). In this section, I will summarize the empirical basis for the "Outcomes" of this program, and their relationship to "Purposes," "Tools," and "Delivery Strategies."

Table 5 – A Summary of Results for Experimental-Type Evaluation Studies of This Program

			Results for Program Aims as Outcome Variables *									
Author, Date	Grades	Curric.	Env. Sens.	Know. Ecol.	Know. Issues	Skill/ Issues	Know. Action A	Know. Action P	Skill/ Action	Locus of Control In.	Locus of Control Gr.	REB
Ramsey, 1979	7th	IEEIA					X					X
Klingler, 1980	8th	IEEIA					X					X
Volk, 1980	8th	IEEIA			X							
Ramsey, 1989	7th	IEEIA	ns				X	X	X	X	X	X
Ramsey, 1993	8th	IEEIA	ns				X	X	X	ns	X	X
Holt, 1988	8th	IEEIA	ns				X	X	X	X	ns	X
Bluhm et al. 1995	6th	IEEIA						X	X			X
Bluhm & McBeth, 1996	6th	IEEIA						X	X			X
Withrow, 1988	5th 6th	Case St.			X		X	X	X	ns	ns	X
Simpson, 1991	5th 6th	Case St.					X		ns	ns	ns	X
Culen, 1996	7th 8th	Case St.		X			X		X	X	ns	X
Jordan, 1986	Non-formal	-					X					X

* Notes:
Under Know. Action, A = Actual, and P = Perceived
Under Locus of Control, In. = Individual, and Gr. = Group
X = significant at $p < .05$; ns = not statistically significant, blank = not measured.

There are several ways of collecting evidence about a program's outcomes. These include: (a) periodic assessment by teachers (e.g., using surveys); (b) periodic assessments of students (i.e., as in standardized testing); (c) evaluation studies using quantitative designs (e.g., experimental-type studies); and (d) evaluation studies using qualitative designs. The developers have used all four of these methods to determine the effects and effectiveness of this program's curricula and teacher preparation efforts.

Results from Experimental-Type Evaluation Studies

This issue and action instruction program is unique in the fields of ARE and EE in that program-related evaluations have been conducted on a regular basis since its first year, 1973, and that many of these evaluations have been experimental in nature. Since the late 1970s, at least 12 experimental-type evaluation studies have explored the effects and effectiveness of issue and action curricula in school classrooms and non-formal settings. Many of these have been reviewed in earlier research documents (Hines 1985; Hungerford 1988; Volk and McBeth 1997; Hungerford, Volk and Ramsey 2000).

The benefit of experimental-type studies such as these is that they can provide sufficient control over internal validity threats to permit cause-and-effect claims to be made with a reasonable degree of certainty or probability (Campbell and Stanley 1963). It is noteworthy that several of these have been replication-type studies to determine if results obtained in an earlier study were or were not due to this program. As stated earlier, the ability to support cause-and-effect claims is central to program impact theory and logic modeling, making experimental-type studies and replications of them particularly valuable.

Experimental-type Studies of IEEIA

These 12 experimental studies have been organized into three groups: classroom studies of IEEIA, classroom studies of extended case studies, and one study conducted for a non-formal program (Table 5). The largest number of quasi-experimental studies have looked at the effects of IEEIA, largely because this is by far the oldest and most widely used of available issue and action curricula. In the first of these studies, Ramsey (1979) compared IEEIA-based instruction with awareness-level case study instruction and with standard science instruction at the 7th grade level. He reported positive results on his two outcome variables, knowledge of action strategies and level of involvement in REB. In 1981, Ramsey oversaw a follow-up study of students who had been involved in his 1979 study. Graduate students were trained to conduct double-blind interviews of students from both treatment and control classes. He found that these graduate students were able to pick out every student from his treatment group on the basis of interview responses alone. Further, he found that students exposed to IEEIA continued to engage in higher levels of REB than did their control group peers despite the absence of any instructional reinforcement (i.e., with only social reinforcement from family, peers, and youth groups) (Ramsey 1981, Hungerford and Volk 1990).

Klingler's study (1980) was undertaken as a replication of Ramsey's earlier study (1979). He used the same material, similar methods, and the same outcome measures, but with 8th grade students. The consistency between his results and Ramsey's results lends credibility to Ramsey's original findings (Table 5).

Ramsey's later studies (Ramsey 1989, 1993; Ramsey and Hungerford 1989) involved seventh and eighth grade teachers who had completed an extended issue and action instruction in-service workshop, and who were implementing IEEIA in their own classrooms. These seventh and eighth grade classes were compared to other classes from those same schools that were exposed to standard science instruction. These studies may be seen as replications and extensions of the earlier studies and of each other, as well as evaluations of the efficacy of the previously described issue and action teacher preparation programs. In these studies, Ramsey drew upon prior research (Ramsey 1979, Peterson 1982, Sia 1985) in developing his outcome measures. In both studies, he used five measures: (a) a Likert-type measure of individual and group locus of control; (b) a phenomenological measure of subjects' overt REB; (c) a Likert-type measure of environmental sensitivity; (d) a phenomenological measure of students' knowledge of environmental action strategies; and (e) a Likert-type measure of perceived knowledge or and skill in using environmental action strategies. In both studies, analyses of data from pre-test measures of variables (a) and (b) indicated that there were no significant differences between treatment and control groups (Ramsey & Hungerford, 1989, p. 33; Ramsey, 1993, p. 34). Further, as reported in Table 5), Ramsey found in both studies that the classes exposed to issue and action instruction scored significantly higher on posttest measures of variables likely to be influenced by issue and action instruction than did the control classes (i.e., with the exception of Individual Locus of Control in the 1993 study). Finally, in both studies, Ramsey reported that treatment/control difference on post measures of environmental sensitivity were not significant. He inferred that while periodic outdoor experiences were prone to influence this variable, classroom-

based issue and action training was not (Ramsey and Hungerford 1989, p. 32; Ramsey 1993, p. 36).

Holt's study (1988) was conducted shortly after the data for Ramsey's 1989 and 1993 studies had been collected (i.e., 1987). Her students were exposed to the same material, similar teaching methods, and the same five outcomes measured used in Ramsey's 1989 and 1993 studies. However, her study is unique in that the students exposed to IEEIA were lower achieving students. Her results indicate that these issue and action curricula can work as well with non-gifted as with gifted students (Table 5).

Two additional quasi-experimental studies of the effects of IEEIA were undertaken in the mid-1990s. In the first (Bluhm, Hungerford, McBeth and Volk 1995), the developers and several colleagues sought to refine and validate their Middle School Environmental Literacy Instrument (MSELI), a more comprehensive measure of learning outcomes associated with environmental literacy. The second study was undertaken as part of this MSELI instrument development effort, and was included in a report on IEEIA to the U.S. Department of Education's National Diffusion Network (Bluhm and McBeth 1996). In both studies, 6th grades exposed to IEEIA (treatment group) were compared to 6th grades exposed to standard instruction (control group). Further both studies used a post-only design and found that the treatment classes outscored the control classes on all three outcome variables: (a) perceived knowledge of environmental action strategies; (b) skill in using environmental action strategies, and (c) self-reported involvement in REB (Hungerford, Volk and Ramsey 2000).

The remaining quasi-experimental study of the effects of IEEIA (Table 5) was conducted by Volk (1981; Volk, Hungerford and Tomera 1981). In it, Volk specifically investigated the effects of issue and action instruction on eighth-grade students' ability to identify and analyze issues. She reported that students exposed to IEEIA were able name more issues, identify more sides to named issues, and provide more rationales for differing sides than did her control sample ($p<.01$). This study provided the evidence to support the addition of the evolving approach to issue analysis to the 1985 edition of IEEIA (Ramsey, Hungerford and Volk 1989).

Experimental-type studies of intermediate-level extended case studies. Several of the studies describe above demonstrated that IEEIA had a more substantial and significant effect on knowledge, skills, and REB than did awareness-level case studies (Ramsey 1979; Childers 1981; Jordan, Hungerford and Tomera 1986). As described earlier, the developers of IEEIA prepared an extended case study version of their issue and action curriculum to overcome the apparent weaknesses of awareness-level case studies, as well as to provide a more appropriate way of providing issue and action instruction to students in intermediate grades. Three quasi-experimental studies were undertaken to determine if the intermediate-level extended case study format would lead to the same learning outcomes as were apparent in studies of IEEIA (Withrow 1988, Simpson 1991, Culen 1996).

In the first of these research studies, Withrow (1988) explored the effect of an unpublished extended case study of his own design (i.e., on deforestation in the Midwest) on fifth and sixth grades using a post-only quasi-experimental design. He reported that the class exposed to the extended case study scored significantly higher than did the class exposed to standard instruction (control class) on five of his seven outcome measures: (a) actual knowledge of environmental issues; (b and c) actual and perceived knowledge of environmental action strategies; (d) skill in using environmental action strategies, and (e) self-reported involvement in REB (Withrow 1988; Hungerford, Volk and Ramsey 2000). He did not find significant differences on his measure of (f and g) individual and group locus of control.

Simpson conducted a similar study involving 15 classrooms of fifth and sixth grades from Illinois and Tennessee. She used an extended case study on Canada geese that she had helped to develop (Culen, Simpson, Hungerford, Ramsey and Volk 1988), and collected data using a post-only control group quasi-experimental design. She measured the same outcome variables as Withrow except for (a) knowledge of issues. On her measured outcome variables, her results were similar to Withrow with one exception. She did not detect a significant difference between treatment (IEEIA) and control classes on (d) their skill in using action strategies (Table 5).

In the most recent of these studies, Culen (1996, Culen and Volk 2000) explored the effects of an extended case study that he had developed on wetlands (Culen 1992). His sample consisted of 15 intact classes of seventh and eighth graders from Illinois and Missouri. His design was similar to Ramsey's (1979) original study, comparing IEEIA-based instruction with awareness-level case study instruction and with standard science instruction (as a control). He used six outcome measures: (a) ecological foundations; (b) actual knowledge of environmental action strategies; (c) skill in using environmental action strategies; (d and e) individual and group locus of control; and (f) self-reported involvement in REB (Culen 1996; Culen and Volk, 2000; Hungerford, Volk and Ramsey 2000). He found significant differences on his three pre-test measures (i.e., a, d, and f),

and therefore used analysis of covariance (ANCOVA) to carry out posttest comparisons. He found that his IEEIA-based group significantly outscored the control group on all but one of these variables (i.e., e above; $p<.05$). He also reported that his IEEIA-based group significantly outscored his awareness-level case study group on the posttest measure of behavior (i.e., f, above).

Experiment-type Studies in a Non-formal Setting

At the time Jordan began his study, only one other study appearing in The Journal of Environmental Education had investigated the effects of a non-formal program on REB (i.e. Asch and Shore 1975). Results from surveys of program during this period suggested that few non-formal programs undertook any form of outcome evaluation (Disinger 1981, Chenery and Hammerman 1984/85). Thus, the study undertaken by Jordan was, and remains today, unique in light of these conditions within the non-formal sector.

Working with six-day residential programs for high school students offered by an environmental center, he set up and compared an awareness-level workshop (i.e. focusing on natural history, ecology, environmental issues, and resource management) with issue and action workshops (i.e., focusing on environmental issues, resource management, and environmental action strategies) (Jordan, 1985; Jordan, Hungerford and Tomera 1985). Material for the latter workshop was derived, in part, from the action paradigm appearing in IEEIA, though did not include the skill development and application material found in earlier chapters of IEEIA. Participants in all workshops underwent both pre- and post-tests using the same two instruments used by Ramsey (1979) and Klingler (1980). His measures of REB were designed to cover the 2-month period prior to each workshop (i.e., administered during the pre-test) and the 2-month period after each workshop (i.e., administered as a delayed post-test).

Jordan (1985; Jordan, Hungerford and Tomera, 1986) reported that participants in the issue and action workshops demonstrated a significant pre-post gain in knowledge of action strategies ($p<.05$), as well as higher level of knowledge of action strategies on the posttest measure than did those in awareness-level workshops. The same results were reported for his measures of self-reported REB. Thus, with some modification and in the hands of trained instructors, non-formal programs can be designed and delivered to help learners more than awareness of problems/issues.

Measurement of Outcome Variables in Experimental-Type Studies

The instruments used in these studies to assess learning outcomes on a pre/post or post-test only basis evolved over time, as this program and its accompanying research and evaluation base evolved. The first instrument (Ramsey 1979; Klingler 1980; Ramsey, Hungerford and Tomera 1981; Jordan 1985) assessed only students' knowledge of environmental action and their level of REB. Even so, Ramsey remains one of the few to use other sources to corroborate self-reported REB data (i.e., to do so, he used a parental questionnaire on a blind basis). His 1979 instrument is shorter and simpler than the multi-sectioned instrument used in Ramsey's later studies (1989, 1993), and in studies by Holt (1988), Withrow (1988), Simpson (1991), and Culen (1996).

Efforts by Ramsey, prior researchers, and other developers helped to evolve and validate a multi-section instrument to assess environmental literacy and evaluate this program at the middle school level. This instrument came to be known as the Middle School Environmental Literacy Instrument (MSELI). By 1993, MSELI was in its fourth edition. Over 1994-95, MSELI received greater scrutiny as part of the "Environmental Education Literacy/Needs Assessment Project" (Bluhm, Hungerford, McBeth and Volk 1995). Following this project, MSELI was further refined and used to evaluate this program (e.g. Bluhm and McBeth 1996). The evolution of this instrument, along with supporting validity and reliability estimates, was chronicled by McBeth (1998). In these ways, the developers of this issue and action program attempted to insure that the instrument used to assess learning outcomes were valid and reliable, as well as consistent with the program's research base. In the language of the logic models presented earlier (Figure 2 and Figure 3), these efforts helped insure that "Participant Outcomes" could be attributed to the "Tool Box," and that these "Participant Outcomes" were conceptually and methodologically consistent with both "Program Purposes" and sought "Program Impacts."

Results from Periodic Assessment of Students

Prior to the widely distributed report, *Closing the Achievement Gap* (Lieberman and Hoody 1998), few efforts had been made to explore or evaluate the effects of EE programs in schools on subject area learning outcomes. Today, in the climate of national and state standards, increased calls for accountability, and increasing use of high-stakes assessments to determine the worth of school programs, few question the need for EE to explore or evaluate these effects. It is noteworthy that before Lieberman began his project and study, and before these trends became prominent in K-12 schooling in the

U.S., Hungerford and his colleagues oversaw at least two such studies. Readers should note that these two studies are substantially different than the previously described classroom evaluation studies in that the outcome variables are measured using standardized tests.

Both of these studies were initiated in 1992. In the first, Gavilla (1992) sought to compare issue and action instruction against more traditional environmental science instruction using the Iowa Test of Basic Skills (ITBS) commonly used in Kansas City area schools. Both classes received instruction over a semester, and were assessed using ITBS on a post-only basis. Gavilla's analysis of scores from the Science Achievement and the Social Studies Achievement Tests indicated that the class exposed to issue and action instruction scored significantly higher than did the class exposed to environmental science instruction ($p<.05$).

Hungerford and his colleagues at Southern Illinois University undertook the second study in 1992. They contacted and received standardized achievement test data from 28 teachers who had been trained in issue and action instruction. These teachers were from eight states (i.e., IA, IL, KY, MD, MO, TN, TX, WI), and taught in grade levels 5 - 12. They reported "ninety-six percent (96%) of the respondents indicated that the achievement of students experiencing this (issue and action) approach was greater than that of peers who had not experienced this training" (Hungerford, Volk and Ramsey, 2000, p. 8). Of these 28 teachers, only one indicated that achievement was only "the same or greater" when compared to standard subject area instruction. They go on to summarize these teachers' results as follows:

> When questioned about the areas of achievement, 86% reported greater achievement in science, 46% reported greater achievement in social studies, 54% reported greater achievement in language arts, and 75% reported greater achievement in library skills. Sixty-one percent (61%) of the respondents reported greater overall achievement on the part of students experiencing the issue investigation approach (2000, p. 8).

In light of the positive results from both studies, Hungerford, Volk, and Ramsey inferred "that the acquisition of those higher order skills (evident in issue and action curricula) permits students to function at a higher order of cognition when approaching the standardized tests of achievement" (2000, p. 7).

Results from Periodic Assessments by Teachers

To date, there have been few attempts to survey teachers about their classroom experiences with, or about the apparent effects of, issue and action instruction. The 1992 survey by Hungerford and his colleagues was presented in the previous section because teachers were reporting results from standardized achievement tests (i.e. as opposed to their own perceptions). Braun (1997) undertook the only other survey of teachers trained in issue and action instruction.

There were two purposes to Braun's study (1997). The first was to survey teachers who had completed at least one issue and action training workshop on a number of independent variables, and four dependent variables (i.e., perceptions of student achievement in four goal areas). The second purpose of this study was to determine the extent to which those independent variables helped explain variability (variance) in the dependent variables using multiple regression and correlation (MRC) statistical methods.

To gather these data, she developed a three-part measure: (Section 1) a measure of eight independent variables (e.g., teaching background, training in and use of issue and action curricula); (Section 2) a dependent measure consisting of 21 learning outcomes in four goal areas; and (Section 3) a measure of an independent variable, "outside influences on classroom implementation." Section 2 was based upon the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b), prior research (Volk 1983), and material emphasized in issue and action curricula. Hungerford, Volk, and Ramsey reviewed a draft of this measure. The final version of it consisted of 21 learning outcomes measured using a five-point student achievement scale (i.e., 0=Not at all, 2=Moderate, 4=Complete).

Braun's sample consisted of 360 teachers from 11 states who had completed at least one issue and action instruction workshop, and whose names appeared in a database managed by faculty at Southern Illinois University as part of their National Diffusion Network (NDN) project. Of these, 99 teachers returned responses, although only 65 of these were usable (i.e., from teachers who had implemented issue and action curricula). With respect to her first purpose, these 65 teachers tended to teach science (n=48), teach in grades 7-8 (n=31), and had completed at least one graduate degree (n=37). On average, they completed two training workshops (mean=1.99), lasting more than two weeks (mean =2.3), and had implemented issue and action instruction for almost two years (mean = 1.97). The majority of these teachers reported using IEEIA or IESTSIS (n=39),

while smaller numbers reported using extended case studies (n=11), or a combination of the two (n=13).

With respect to the dependent variables, teachers' perceptions of student achievement were highest for learning outcomes under Goal Level 2: Issue Awareness (mean =2.55). This followed by outcomes under Goal Level 3: Issue investigation/evaluation (mean =2.37) and under Goal Level 1: Ecological Foundations (mean =2.28). The latter can be partially explained by the fact that majority of teachers reported using IEEIA/IESTSIS, neither of which were designed to address Goal Level 1. The teachers' lowest perceptions of student achievement were for learning outcomes under Goal Level 4: Citizen action skills (mean =1.80, or below "Moderate"). It is noteworthy that these teacher perceptions pertain to achievement of learning outcomes related to action-related knowledge and skills. This may help to explain their apparent inconsistency with the positive results on REB, or action-related behavior, reported in all of the classroom evaluation studies (see Table 5). Two other plausible explanations for the apparent inconsistency between these ratings and prior results are (a) students may engage in a higher level of REB through exposure to this program as a whole, even when teachers and students do not address all elements of action training in these curricula, and (b) teachers' perceptions of student learning outcomes associated with Goal Level 4 may not adequately reflect students' out-of-school involvement in REB, and therefore may be limited.

The results of Braun's MRC analyses are interesting. She reported that the list of 11 "Outside Influences" was the only independent variable found to serve as a significant predictor of student achievement for each of the four goal levels ($p<.05$). Further analyses were not carried out to determine which of these eleven may be influence teachers' perceptions of student achievement at each goal level (e.g., administrative support, prior knowledge of ecology and environmental science, fit to their school's curriculum). Only two other independent variables were found to serve as significant first-order predictors of teachers' perceptions of student achievement: for Goal Level 1: Ecological foundations, the grade level at which they taught; and for Goal Level 2: Issue awareness, the subject area in which they taught. In light of teachers' perceptions and these results, Braun called for research of both a quantitative and qualitative nature.

Results from a Qualitative Evaluation Study

At least within the U.S., limited attention has been given to qualitative evaluation in the fields of ARE and EE. This is also true for this issue and action instruction program. For this program, the low level of attention to qualitative evaluation parallels the level of attention given to periodic assessments of students and to assessments by teachers (i.e., in comparison to the substantial attention that has been given to experimental-type classroom evaluation studies). There are mitigating reasons for this. From an historical perspective, many of the experimental-type evaluation studies of this program were carried out prior to the rise of qualitative methods in EE in the 1990s (Mrazek, 1993; see Table 5). Further, from a practical perspective, the amount of training, preparation, time, and effort required to carry out sound qualitative evaluation studies has often limited their use. Finally, from the developers' perspective and the perspective of logic modeling, experimental-type studies provide evidence regarding cause-and-effect claims, and therefore are of unique value to this program. Given these factors, it is noteworthy that Winther (1999) decided to carry out a qualitative evaluation of this issue and action program for his dissertation.

In this study, Winther (1999) explored teacher decision-making during the first year of implementation of IEEIA (i.e., following their completion of a summer training workshop). From the teachers who completed this workshop and who volunteered to participate in this study, he randomly selected eight teachers: three high school, two middle school, and three elementary teachers. Selected teachers were from different states (e.g., MD, MO, TX).

His final four questions focused on: (1) what motivated teachers to participate in the training for and to implement IEEIA; (2) teachers' perceptions of this training; (3) how teachers working with IEEIA perceive the support they receive from peers and administrators; and (4) the perceptions and reactions of teachers as they implement (or interact) with IEEIA. While this study was not designed to do so, these questions clearly explored variables or factors included in Braun's (1997) list of "Outside Influences" that were found to predict teachers' perceptions of student achievement in this program (e.g., prior knowledge of ecology and environmental science, fit of issue instruction to their curriculum, adequacy of preparation, support from administration).

To gather information and perceptions needed to respond to these research questions, he interviewed each teacher three times: at the close of the summer workshop prior to implementation, at midyear during implementation, and at the end of the spring term toward the end of implementation. Other sources used to verify these teachers' responses included visits to their schools, examination of teacher- and student-prepared materials, interviews with their students, informal discussions with peer teachers at their school, and implementation reports they submitted. Winther's qualitative methods reflect a

naturalistic approach, inductive process, design flexibility, and personal contact, as well as use prolonged engagement and triangulation to help establish the dependability and credibility of information and perceptions (Guba 1981, Patton 1990).

In response to the first two research questions above, Winther concluded that:

> Participants initially found the training difficult and confusing. As they continued training and implementation some participants found that the program was substantially different from what they were accustomed to doing in their classrooms. Some participants were reluctant to implement the program ... Others implemented the program fully, and were extremely enthusiastic about what their students were doing and learning (1999, Abstract).

With respect to the third research question noted above, Winther reported that support from administrators and peers was important, but not as important as previously thought.

> Administrators were perceived as supporting the program [IEEIA] because the program helped facilitate goals that had largely been established in the school. Peer support was social and largely passive. Participants perceived that neither administrators nor peers really understood how the program worked (1999, Abstract).

Winther concluded that teachers' perceptions of the training, the program, and support base stemmed from what he referred to as "cognitive changes" stimulated by the training and program. "Comments from all of the teachers reflected reactions to these changes. Some teachers resisted the changes, while others enjoyed the process" (1999, Abstract).

Winther's study confirms what the developers, trainers, and researchers associated with this program have learned through experience; i.e., some teachers are more "ready" than others to change the way in which they perceive the teaching and learning process, and their own roles in that process. To effectively use this issue and action program, teachers must be willing to change and grow. For this reason, Winther (1999) has recommended that factors associated with "teacher decision-making" (i.e., this change process), be explored in greater depth. From a practical perspective, research of that kind could help guide workshop advertising, recruitment, and selection processes. From the perspective of logic modeling, research of that kind could be used to insure that the "Delivery Approaches" for this program's "Tools" and methods to "Support Tool Use" were appropriate for its intended "Target Audiences."

Recommendations

For the 28 years over which this issue and action program has evolved, much has been learned that is relevant to the goals of Stewardship Education, be that in the field of ARE or EE. Its developers have learned much about designing and developing skill-based and project-driven curricula such as IEEIA and extended case studies, and about how to prepare teachers to effectively use these curricula. They have carried out research studies and supported the synthesis of research in an effort to use empirical findings to help guide the evolution of these curricula and their teacher preparation programs. They have also carried out various kinds of evaluations to determine how well these curricula and teacher preparation programs are working, and to further refine them. This systematic use of data, coupled with attention to what has worked in practice, has made this issue and action program sound, credible, and somewhat unique in ARE and EE. While this issue and action program is not as widely used across the U.S. as some other ARE or EE programs, the logic models that under-gird this program, as described in this paper, are substantial. For that reason, its key elements deserve careful scrutiny and consideration by any professionals who work in the area of Stewardship Education. On the basis of the accomplishments (to date) within this issue and action program, the following recommendations are offered to professionals working in the area of Stewardship Education.

Purposes

1. The organization's mission, overall educational aims, more specific education program goals, and instructional objectives should be aligned with one another so that they all clearly reflect the nature and purpose of Stewardship Education: To prepare learners to be actively involved in the stewardship of ecological and natural resources.

2. The organization's educational aims should reflect the best of what is known about what it takes for citizens to become actively and effectively involved in stewardship efforts on a sustained basis. In this paper, I have suggested that these aims are apparent in evolving, research-based models of environmental literacy (Simmons 1995, Wilke 1995, Volk and McBeth 1997).

3. The organization's educational goals and objectives should be structured and sequenced in such a way that they encompass and foster what is known about environmental literacy (aims).
   (a) These goals and objectives should not be limited to awareness, knowledge, and/or attitudes if stewardship is a desired outcome. These goals and objectives must also address the other affective dispositions (e.g., locus of control, assumption of personal responsibility), skills, and participation strategies that are more closely related to learner (and citizen) participation in stewardship.
   (b) Further, these goals and objectives should not focus solely upon the natural world, or even upon problems and issues if stewardship is a sought program impact. These goals and objectives must focus, at least in part, on the kinds of solutions and service/action projects that make stewardship a concrete reality. In this paper, I have indicated that the developers of this program have used and adapted the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton and Wilke 1980b) as their guide for program goals and objectives.

4. Program goals and objectives should be viewed as anticipated learning outcomes, and compared to a program's actual learning outcomes as determined through assessment and evaluation efforts. This involves linking Program "Purposes" to "Outcomes" and "Impacts" on an empirical basis.

Curricula

5. Curricula for stewardship education should be structured in such a way that learners will be provided with a well-thought-out sequence of opportunities to develop, build upon or practice, and eventually apply their awareness, knowledge, affective dispositions, skills, and participation strategies. To accomplish this, the developers of this program have relied on the Goals for Curriculum Development in Environmental Education (Hungerford, Peyton, & Wilke, 1980b), as well as their knowledge of skill development and application methods, and methods for overseeing student projects.

6. Stewardship-oriented curricula that are project-driven should be structured so that learners are adequately prepared to undertake each step of that project. Further, they should be structured so that teachers can prepare learners for (as instructors) and guide learners through (as facilitators) the entire project process.

7. These opportunities for learners to develop, build upon or practice, and eventually apply their awareness, knowledge, affective dispositions, skills, and participation strategies should take into consideration the learners' developmental level(s), prior knowledge and experience, and aptitude (i.e., these opportunities should be challenging, but within their reach). To reflect these considerations, IEEIA was designed for use with middle level students, while many of the earlier extended case studies were designed for younger learners (see differences in "Delivery Strategies" in Figures 2 and 3).

8. Curricula should be periodically reviewed and, as appropriate revised to reflect recent feedback from teachers and learners, results of recent assessment and evaluation studies, results from recent research studies and syntheses, and other sources (e.g., national and state standards; parents). The earlier narrative on the evolution of IEEIA is a good example of how this has been done within this issue and action program.

Teacher Preparation

9. When preparing teachers to work with stewardship-oriented programs and curricula, adequate time must be provided for teachers to develop, build upon or practice, and eventually apply their own awareness, knowledge, affective dispositions, skills, and participation strategies. One-shot workshops will never be able to accomplish this. If prolonged in-service workshops such as those used with this issue and action program, are not available, other options should be considered (e.g., a series of workshops for the same teachers).

10. Teacher preparation programs should help teachers become intimately familiar with curricula and other resources they will be asked or expected to use in their own classrooms. This is why all graduate courses and in-service workshops for this program emphasize the use of program curricula.

11. When preparing teachers to use stewardship-oriented curricula that are project-driven, teachers must be provided with an opportunity to engage in such projects themselves, even if on a somewhat simplified basis. As has been the experience in this issue and action program, only when teachers engage in projects themselves do they become more fully aware of project requirements, components, procedures, difficulties, and associated evaluation and grading procedures.

12. When preparing teachers to use stewardship-oriented curricula, several other features will often increase teachers' effective use of them, as has been apparent in this issue and action program:
    (a) Providing these teachers with adequate support as they plan and implement that curriculum. This should include instructional, resource, and assessment support;
    (b) Providing these teachers with opportunities to share with other trained teachers their questions and efforts related to curriculum planning, implementation, and assessment and evaluation; and
    (c) Providing these teachers with subsequent opportunities to refresh and expand upon what they got out of initial preparation opportunities (e.g., extended workshops).

Assessment and Evaluation

13. Evaluations of ARE and EE programs must move beyond the collection of program outputs (i.e., number counts and feedback; see Chenery AND Hammerman 1984/85) to include the assessment of learning outcomes and, whenever feasible, longer-term program impacts. In this issue and action program, assessment of learning outcomes has been viewed and undertaken in this manner since 1973, particularly in the previously described classroom evaluation studies. In some studies, program impacts have also been assessed (e.g., Ramsey 1981).

14. In many instances, the assessment of learning outcomes will be undertaken for evaluation purposes (e.g., in most classrooms). When appropriate, the assessment of learning outcomes should include pre-assessment (e.g., on prerequisites, instructional objectives), formative assessments, and summative assessment. In some instances, the assessment of learning outcomes may be undertaken for research purposes (e.g., in classroom studies for theses and dissertations). In these cases, the use of pre-testing (i.e., a form of or a substitute for pre-assessment) and post-testing (i.e., a form of or substitute for summative assessment) should also reflect appropriate research procedures and controls (e.g., as in Culen 1996).

15. As recommended under the Purposes Section above, learning outcomes to be assessed should not be limited to the main features of the KAB model (i.e., awareness, knowledge, and attitudes). Rather, efforts should be made to assess a broader range of learning outcomes associated with environmental literacy and stewardship (e.g., the other affective dispositions such as locus of control, assumption of personal responsibility, skills, participation strategies). Assessment instruments such as the MSELI used in this issue And action program (Bluhm, Hungerford, McBeth and Volk 1995; McBeth 1997), and the related SSELI (Marcinkowski and Rehrig 1995) offer some ideas as to how this can be done.

16. Regardless of whether the assessment of learning outcomes is undertaken using quantitative and/or qualitative methods, steps should be taken to insure that resulting assessment data are "trustworthy" (Guba 1981). In quantitative terms, this means that steps must be taken to insure that assessment instruments yield valid and reliable data. In qualitative terms, this means that other methods must used to insure that the resulting assessment data are credible and dependable (Guba 1981). In this issue and action program, substantial attention has been given to instrument validity and reliability (Bluhm, Hungerford, McBeth and Volk 1995; McBeth 1997), particularly when this has involved the collection of self-reported data (e.g., Ramsey 1979) and perception data (see Table 5 for studies measuring both actual and perceived knowledge of action strategies). Further, in Winther's (1999) qualitative evaluation study, clear attention was given to methods recommended by Guba (1981) and others to insure credibility and dependability.

17. The results of evaluation-oriented assessments of learning outcomes should be used by program staff as opportunities for the purposes of program learning (i.e., how this program is working) and program improvement (i.e., where a program's curricular, instructional, and/or assessment practices need to be improved). Once a program is well defined and established, as with this issue and action program, research-oriented assessment results may be used for other purposes, including program validation (Bluhm and McBeth 1996) and logic modeling, as has been done in this paper.

Research

18. One of the most influential decisions to be made in any stewardship education program is whether or not to design, develop, implement, and assess/evaluate that program in light of prior research. In ARE and EE, many programs still rely on the ineffective KAB model described earlier, an indication that inadequate attention is being paid to prior research. The evolving research base in EE, including the previously described research base for this issue and action program, provides strong cues as to what stewardship education programs should in-

clude and address. As a profession, we need to pay greater attention to what has been learned through research

19. Once the above decision has been made, it is also important that professional educators stay current with this evolving body of research and participate in its evolution. For many in the fields of ARE and EE, both of these activities will require some additional training to enable them to do so (e.g., in research methods, as critical consumers of research, as collaborators in research). The developers of this program and many of its trainers have been both beneficiaries of and provider of this through graduate-level research training.

20. From the perspective of logic modeling, many important research questions can and should be generated by asking about the relationships between/among a program's elements. A list of general questions drawn from logic modeling prepared by Rossi, et al. (1999), was presented earlier in the paper. If needed, that list and the general logic model (Figure 1) can serve as a starting point. Beyond that, in the fields of ARE and EE, one of the most fundamental questions to be asked and explored is this: "Are our goals and objectives, our tools, and our methods sufficient to help learners to attain learning outcomes that are critical to their effective participation in stewardship activities?". This question has been given substantial attention by Hungerford and his colleagues, as is reflected in the research and the evaluation efforts that are summarized herein.

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